

APPENDIX E.2

ADDITIONAL FISH TISSUE COMPARISONS

TABLE E.2-1
COMPARISON OF COPC CONCENTRATIONS IN BROWN BULLHEAD TISSUE 3 TO REFERENCE SAMPLES AND TISSUE RESIDUE BENCHMARKS
REACH 3
WELLS G&H SUPERFUND SITE OU3

Chemical of Potential Concern	Brown Bullhead - Fillet						Brown Bullhead - Offal						Tissue Benchmark Conc. mg/kg	Species (2)	Effect	Endpoint	Fraction	Exposure Route	Life-Stage	Effect	ERED Reference ID (3)
	Study Area Average Conc. mg/kg bw	Reference Average Conc. mg/kg bw	Ratio	Study Area (1) Average Conc. u g/g lipid	Reference Average Conc. u g/g lipid	Ratio	Study Area Average Conc. mg/kg bw	Reference Average Conc. mg/kg bw	Ratio	Study Area (1) Average Conc. u g/g lipid	Reference Average Conc. u g/g lipid	Ratio									
SVOCs																					
Benzo(g,h,i)perylene	0.53	0.55	1.0	112	55	2.0	nd	nd	nd	nd	nd	nd	29.56	<i>Cyprinus carpio</i> (common carp)	Physiological	NOED	Liver	Injection	na	No significant increase in EROD enzyme and CYP 1A protein content.	URS218
Pesticides																					
4,4'-DDD	0.0056	0.0035	1.6	1.2	0.39	3.2	0.019	0.0069	2.7	1.5	0.45	3.3	0.6	<i>Pimephales promelas</i> (fathead minnow)	Reproduction	LOED	Whole Body	Combined	Adult	Sig. different from control	JAW4
4,4'-DDE	0.0077	0.019	0.40	1.7	2.4	0.70	0.023	0.039	0.59	1.9	2.6	0.75	na	<i>Pimephales promelas</i> (fathead minnow)	Reproduction	NOED	Whole Body	Ingestion	Adult	Hatchability	JA219
4,4'-DDT	0.0016	0.0016	1.0	0.32	0.20	1.6	0.0027	0.0039	0.71	0.25	0.26	1.0	12.2	<i>Ictalurus punctatus</i> (channel catfish)	Growth	LOED	Brain	Ingestion	Immature	40% reduction in mean weight	URS104
Aldrin	0.00033	0.00082	0.40	0.073	0.10	0.72	0.0014	0.0020	0.70	0.13	0.14	1.0	na	<i>Brachydanio rerio</i> (zebra fish)	Growth	NOED	Whole Body	Water	na	Weight	JA41
alpha-Chlordane	0.0056	0.00082	6.8	1.3	0.10	12.3	0.020	0.0020	10	1.6	0.14	12	na	<i>Ictalurus punctatus</i> (channel catfish)	Growth	LOED	Brain	Ingestion	Immature	40% reduction in mean weight	URS104
Aroclor-1248	0.0030	0.0079	0.38	0.67	1.0	0.67	0.013	0.020	0.67	1.2	1.3	0.90	3.7999 *	<i>Lepomis macrochirus</i> (bluegill)	Growth	NOED	Whole Body	Absorption	na	No increase in mortality	JA23
Aroclor-1254	0.02	0.007	2.29	0.0003	0.0001	3.23	0.06	0.02	3.7	0.0006	0.0001	5.54	4,240	<i>Cyprinodon variegatus</i> (sheepshead minnow)	Development	LOED	Whole Body	Absorption	Immature	Decreased time to hatch	URS198
Aroclor-1260	0.031	0.071	0.43	6.8	8.0	0.85	0.088	0.14	0.65	7.9	8.7	0.90	3.7999 *	<i>Lepomis macrochirus</i> (bluegill)	Growth	NOED	Whole Body	Water	na	No effect on mortality	URS10
beta-BHC	0.00031	0.00082	0.38	0.069	0.10	0.67	0.0013	0.0020	0.66	0.12	0.14	0.89	na	<i>Lepomis macrochirus</i> (bluegill)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on mortality	JB5
delta-BHC	0.00045	0.00082	0.55	0.096	0.10	0.93	0.0015	0.0020	0.77	0.14	0.14	1.0	na	<i>Cyprinodon variegatus</i> (sheepshead minnow)	Development	LOED	Whole Body	Absorption	Egg-embryo	Decreased time to hatch	URS230
Endosulfan I	0.00030	0.00082	0.37	0.068	0.10	0.66	0.0013	0.0020	0.66	0.12	0.14	0.89	na	<i>Lepomis macrochirus</i> (bluegill)	Growth	LOED	Gill	Combined	Immature	Effect on growth - over 22 month period	URS230
Endosulfan sulfate	0.00060	0.0016	0.38	0.13	0.20	0.67	0.0025	0.0039	0.66	0.23	0.26	0.89	na	<i>Pimephales promelas</i> (fathead minnow)	Mortality	NOED	Whole Body	Absorption	Immature	Sig. reduction in feeding rate and ineffective feeding behaviors	URS160
Endrin aldehyde	0.00073	0.0016	0.47	0.16	0.20	0.80	0.0049	0.0039	1.3	0.44	0.26	1.7	0.08	<i>Perca flavescens</i> (yellow perch)	Growth	NOED	Whole Body	Combined	Adult	No effect after 2 years, tissue concentration after one year	JA88
gamma-Chlordane	0.0035	0.00082	4.3	0.80	0.10	7.8	0.013	0.0020	6.3	0.98	0.14	7.2	na	<i>Micropterus salmoides</i> (largemouth bass)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on survivorship	URS232
Inorganics																					
Aluminum	2.1	1.2	1.8				67	13	5.2				na	<i>Lepomis macrochirus</i> (bluegill)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on mortality	URS10
Antimony	0.080	0.044	1.8				0.14	0.049	2.8				na	<i>Cyprinodon variegatus</i> (sheepshead minnow)	Development	LOED	Whole Body	Absorption	Egg-embryo	Decreased time to hatch	URS198
Arsenic	0.14	0.042	3.4				1.2	0.046	27				0.52	<i>Lepomis macrochirus</i> (bluegill)	Growth	LOED	Gill	Combined	Immature	Effect on growth - over 22 month period	JB5
Barium	0.074	0.085	0.87				5.7	4.2	1.4				na	<i>Lepomis macrochirus</i> (bluegill)	Mortality	NOED	Whole Body	Absorption	Immature	Sig. reduction in feeding rate and ineffective feeding behaviors	URS230
Cadmium	0.011	0.0060	1.8				0.080	0.0068	12				0.9	<i>Micropterus salmoides</i> (largemouth bass)	Development	LOED	Whole Body	Absorption	Egg-embryo	No effect after 2 years, tissue concentration after one year	URS232
Chromium	0.092	0.043	2.1				1.4	0.26	5.6				na	<i>Micropterus salmoides</i> (largemouth bass)	Growth	LOED	Gill	Combined	Immature	No effect on survivorship	URS160
Cobalt	0.029	0.020	1.5				0.15	0.022	6.6				na	<i>Lepomis macrochirus</i> (bluegill)	Mortality	NOED	Whole Body	Absorption	Immature	Effect on growth - over 22 month period	JB5
Copper	0.46	0.21	2.2				2.4	0.97	2.5				13	<i>Micropterus salmoides</i> (largemouth bass)	Development	LOED	Whole Body	Absorption	Egg-embryo	Decreased time to hatch	URS198
Iron	8.7	18	0.50				306	329	0.93				na	<i>Pimephales promelas</i> (fathead minnow)	Growth	NOED	Whole Body	Combined	Immature	Effect on growth - over 22 month period	JB5
Lead	0.040	0.060	0.66				1.7	0.67	2.5				0.451	<i>Perca flavescens</i> (yellow perch)	Mortality	NOED	Whole Body	Absorption	Immature	Sig. reduction in feeding rate and ineffective feeding behaviors	URS230
Manganese	0.12	0.30	0.39				3.4	36	0.10				na	<i>Micropterus salmoides</i> (largemouth bass)	Development	LOED	Whole Body	Absorption	Egg-embryo	Decreased time to hatch	URS198
Mercury	0.037	0.044	0.85	8.9	5.3	1.7	0.038	0.018	2.1	3.8	1.2	3.2	0.135	<i>Micropterus salmoides</i> (largemouth bass)	Growth	NOED	Whole Body	Combined	Adult	No effect after 2 years, tissue concentration after one year	URS232
Nickel	0.025	0.020	1.3				0.094	0.022	4.2				na	<i>Micropterus salmoides</i> (largemouth bass)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on survivorship	URS160
Selenium	0.35	0.62	0.57				0.56	0.75	0.75				3	<i>Lepomis macrochirus</i> (bluegill)	Development	LOED	Whole Body	Absorption	Egg-embryo	Decreased time to hatch	URS198
Silver	0.019	0.016	1.2				0.078	0.018	4.4				0.12	<i>Micropterus salmoides</i> (largemouth bass)	Growth	NOED	Whole Body	Water	Juvenile	na	URS230
Zinc	5.9	6.2	1.0				31	22	1.4				na	<i>Micropterus salmoides</i> (largemouth bass)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on survivorship	URS160

ERED - U.S. Army Corps of Engineers and U.S. Environmental Protection Agency Environmental Residue-Effects Database (last update - February 1998)

Conc. - concentration

ID - identification number

na - no test data available in the ERED database

NOED - no observed effect dose

LOED - lowest observed effect dose

nd - not detected in this data set

Ratio = study area average concentration divided by reference average concentration

(1) With exception of mercury, lipid normalized tissue concentrations were not calculated for inorganic COPCs because inorganics are not expected to preferentially concentrate in lipid material

(2) ERED database records

TABLE E.2-2
COMPARISON OF COPC CONCENTRATIONS IN BROWN BULLHEAD TISSUE TO TISSUE RESIDUE BENCHMARKS
REACH 6
WELLS G&H SUPERFUND SITE OU3

Chemical of Potential Concern	Brown Bullhead - Fillet						Brown Bullhead - Offal						Tissue Benchmark Conc. mg/kg	Species (2)	Effect	Endpoint	Fraction	Exposure Route	Life-Stage	Effect	ERED Reference ID (3)	
	Study Area	Reference Average Conc. mg/kg bw	Ratio	Study Area(1)	Reference Average Conc. u g/g lipid	Ratio	Study Area	Reference Average Conc. mg/kg bw	Ratio	Study Area(1)	Reference Average Conc. mg/kg bw	Ratio										
SVOCs																						
Benzo(g,h,i)perylene	0.55	0.55	1.0	110	55	2.0	nd	nd		nd	nd		29.56	<i>Cyprinus carpio</i> (common carp)	Physiological	NOED	Liver	Injection	na	No significant increase in EROD enzyme and CYP 1A protein content.	URS218	
Pesticides																						
4,4'-DDD	0.0040	0.0035	1.2	0.80	0.39	2.1	0.023	0.0069	3.3	1.2	0.45	2.5	0.6	<i>Pimephales promelas</i> (fathead minnow)	Reproduction	LOED	Whole Body	Combined	Adult	Sig. different from control	JAW4	
4,4'-DDE	0.0061	0.019	0.32	1.2	2.4	0.51	0.033	0.039	0.86	1.7	2.6	0.64	na	<i>Pimephales promelas</i> (fathead minnow)	Reproduction	NOED	Whole Body	Ingestion	Adult	Hatchability	JA219	
4,4'-DDT	0.00055	0.0016	0.35	0.11	0.20	0.55	0.0020	0.0039	0.51	0.098	0.26	0.37	12.2	<i>Ictalurus punctatus</i> (channel catfish)	Growth	LOED	Brain	Ingestion	Immature	40% reduction in mean weight	URS104	
Aldrin	0.00028	0.00082	0.34	0.055	0.10	0.54	0.0010	0.0020	0.50	0.050	0.14	0.37	na	<i>Brachydanio rerio</i> (zebra fish)	Growth	NOED	Whole Body	Water	na	Weight	JA41	
alpha-Chlordane	0.0036	0.00082	4.4	0.72	0.10	7.0	0.019	0.0020	9.5	0.95	0.14	7.0	na	<i>Ictalurus punctatus</i> (channel catfish)	Growth	LOED	Brain	Ingestion	Immature	40% reduction in mean weight	URS104	
Aroclor-1248	0.0079	0.0079	1.0	1.6	1.0	1.6	0.033	0.020	1.7	1.7	1.3	1.3	3.7999 ^a	<i>Lepomis macrochirus</i> (bluegill)	Growth	NOED	Whole Body	Absorption	na	No increase in mortality	JA23	
Aroclor-1254	0.02	0.007	2.17	0.0003	0.0001	2.94	0.08	0.02	4.6	0.0004	0.0001	3.92	4,240									
Aroclor-1260	0.025	0.071	0.35	5.0	8.0	0.63	0.14	0.14	1.0	7.0	8.7	0.80	3.7999 ^a									
beta-BHC	0.00028	0.00082	0.34	0.055	0.10	0.54	0.0010	0.0020	0.50	0.050	0.14	0.37	na									
delta-BHC	0.00028	0.00082	0.34	0.055	0.10	0.54	0.0010	0.0020	0.50	0.050	0.14	0.37	na									
Endosulfan I	0.00038	0.00082	0.47	0.076	0.10	0.74	0.0020	0.0020	1.0	0.10	0.14	0.74	na									
Endosulfan sulfate	0.00055	0.0016	0.35	0.11	0.20	0.55	0.0020	0.0039	0.51	0.098	0.26	0.37	na									
Endrin aldehyde	0.00055	0.0016	0.35	0.11	0.20	0.55	0.0020	0.0039	0.51	0.098	0.26	0.37	0.08									
gamma-Chlordane	0.0025	0.00082	3.1	0.50	0.10	4.9	0.014	0.0020	7.0	0.70	0.14	5.2	na									
Inorganics																						
Aluminum	1.3	1.2	1.1				4.9	13	0.4				na									
Antimony	0.050	0.044	1.1				0.049	0.049	1.0				na									
Arsenic	0.17	0.042	4.07				0.096	0.046	2.10				0.52	<i>Lepomis macrochirus</i> (bluegill)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on mortality	URS10	
Barium	0.080	0.085	0.9				1.2	4.2	0.3				na									
Cadmium	0.023	0.0060	3.8				0.017	0.0068	2.5				0.9	<i>Cyprinodon variegatus</i> (sheepshead minnow)	Development	LOED	Whole Body	Absorption	Egg-embryo	Decreased time to hatch	URS198	
Chromium	0.097	0.043	2.3				0.38	0.26	1.5				na									
Cobalt	0.054	0.020	2.7				0.023	0.022	1.01				na									
Copper	0.80	0.21	3.9				0.71	0.97	0.74				13	<i>Lepomis macrochirus</i> (bluegill)	Growth	LOED	Gill	Combined	Immature	Effect on growth - over 22 month period	JB5	
Iron	44	18	2				181	329	0.55				na									
Lead	2.3	0.060	38.3				0.26	0.67	0.39				0.451	<i>Pimephales promelas</i> (fathead minnow)	Behavior	LOED	Brain	Absorption	Immature	Sig. reduction in feeding rate and ineffective feeding behaviors	URS230	
Manganese	1.5	0.30	4.79				6.6	36	0.19				na									
Mercury	0.018	0.044	0.4	3.6	5.3	0.68	0.0092	0.018	0.5	0.46	1.2	0.39	0.135	<i>Perca flavescens</i> (yellow perch)	Growth	NOED	Whole Body	Combined	Adult	No effect after 2 years, tissue concentration after one year	URS232	
Nickel	0.023	0.020	1.15				0.023	0.022	1.01				na									
Selenium	0.45	0.62	0.7				0.52	0.75	0.7				3	<i>Micropterus salmoides</i> (largemouth bass)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on survivorship	URS160	
Silver	0.019	0.016	1.2				0.018	0.018	1.0				0.12	<i>Lepomis macrochirus</i> (bluegill)	Mortality	NOED	Whole Body	Water	Juvenile	na	JA88	
Zinc	6.9	6.2	1.1				22	22	1.0				na									

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LOED - lowest observed effect dose

nd - not detected in this data set

Ratio = study area average concentration divided by reference average concentration

(1) With exception of mercury, lipid normalized tissue concentrations were not calculated for inorganic COPCs because inorganics are not expected to preferentially concentrate in lipid material

(2) ERED database records of several freshwater fish were queried - members of Ictaluridae, Centrachidae, Cyprinidae, Percidae, and Esocidae.

(3) Citations for primary references are provided in the ERED database

(4) Value for Endrin

a Test involved PCBs, specific congeners not indicated

TABLE E.2-3
COMPARISON OF COPC CONCENTRATIONS IN EEL TISSUE TO TISSUE RESIDUE BENCHMARKS
REACH 6
WELLS G&H SUPERFUND SITE OU3

Chemical of Potential Concern	Eel - Whole Body						Tissue Benchmark Conc. mg/kg	Species (2)	Effect	Endpoint	Fraction	Exposure Route	Life-Stage	Effect	ERED Reference ID (3)
	Study Area	Reference Average Conc. mg/kg bw	Ratio	Study Area (1)	Reference Average Conc. u g/g lipid	Ratio									
SVOCs															
Benzo(g,h,i)perylene	1.9	2.2	0.86	35	32	1.1	29.56	<i>Cyprinus carpio</i> (common carp)	Physiological	NOED	Liver	Injection	na	No significant increase in EROD enzyme and CYP 1A protein content.	URS218
Pesticides															
4,4'-DDD	0.17	0.012	14	1.9	0.16	12	0.6	<i>Pimephales promelas</i> (fathead minnow)	Reproduction	LOED	Whole Body	Combined	Adult	Sig. different from control	JAW4
4,4'-DDE	0.35	0.075	4.6	4.3	1.1	3.9	na	<i>Pimephales promelas</i> (fathead minnow)	Reproduction	NOED	Whole Body	Ingestion	Adult	Hatchability	JA219
4,4'-DDT	0.026	0.0043	6.1	0.32	0.059	5.3	12.2	<i>Ictalurus punctatus</i> (channel catfish)	Growth	LOED	Brain	Ingestion	Immature	40% reduction in mean weight	URS104
Aldrin	0.0014	0.0010	1.3	0.016	0.013	1.2	na	<i>Brachydanio rerio</i> (zebra fish)	Growth	NOED	Whole Body	Water	na	Weight	JA41
alpha-Chlordane	0.053	0.0023	23	0.64	0.027	23	na	<i>Ictalurus punctatus</i> (channel catfish)	Growth	LOED	Brain	Ingestion	Immature	40% reduction in mean weight	URS104
Aroclor-1248	0.013	0.010	1.3	0.15	0.13	1.2	3.7999 ^a	<i>Lepomis macrochirus</i> (bluegill)	Growth	NOED	Whole Body	Absorption	na	No increase in mortality	JA23
Aroclor-1254	0.15	0.01	14.9	0.0002	0.00001	15.6	4,240								
Aroclor-1260	0.53	0.11	4.9	6.7	1.6	4.2	3.7999 ^a								
beta-BHC	0.0014	0.0010	1.4	0.016	0.013	1.3	na								
delta-BHC	0.0013	0.0010	1.2	0.015	0.013	1.2	na								
Endosulfan I	0.0013	0.0010	1.3	0.015	0.013	1.2	na								
Endosulfan sulfate	0.0041	0.0021	2.0	0.046	0.026	1.8	na								
Endrin aldehyde	0.0071	0.0022	3.3	0.084	0.029	2.9	0.08								
gamma-Chlordane	0.017	0.0011	15	0.21	0.014	16	na								
Inorganics															
Aluminum	1.6	3.0	0.53				na								
Antimony	0.051	0.050	1.0				na								
Arsenic	0.047	0.048	1.0				0.52	<i>Lepomis macrochirus</i> (bluegill)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on mortality	URS10
Barium	0.21	0.26	0.82				na								
Cadmium	0.021	0.030	0.70				0.9	<i>Cyprinodon variegatus</i> (sheepshead minnow)	Development	LOED	Whole Body	Absorption	Egg-embryo	Decreased time to hatch	URS198
Chromium	0.083	0.098	0.9				na								
Cobalt	0.022	0.023	1.0				na								
Copper	0.42	0.40	1.04				13	<i>Lepomis macrochirus</i> (bluegill)	Growth	LOED	Gill	Combined	Immature	Effect on growth - over 22 month period	JB5
Iron	24	37	0.6				na								
Lead	0.26	0.082	3.19				0.451	<i>Pimephales promelas</i> (fathead minnow)	Behavior	LOED	Brain	Absorption	Immature	Sig. reduction in feeding rate and ineffective feeding behaviors	URS230
Manganese	2.2	3.0	0.75				na								
Mercury	0.050	0.23	0.21	0.69	3.7	0.19	0.135	<i>Perca flavescens</i> (yellow perch)	Growth	NOED	Whole Body	Combined	Adult	No effect after 2 years, tissue concentration after one year	URS232
Nickel	0.029	0.034	0.9				na								
Selenium	0.82	0.78	1.0				3	<i>Micropterus salmoides</i> (largemouth bass)	Mortality	NOED	Whole Body	Absorption	Immature	No effect on survivorship	URS160
Silver	0.022	0.018	1.2				0.12	<i>Lepomis macrochirus</i> (bluegill)	Mortality	NOED	Whole Body	Water	Juvenile	na	JA88
Zinc	28	27	1.0				na								

ERED - U.S. Army Corps of Engineers and U.S. Environmental Protection Agency Environmental Residue-Effects Database (last update - February 1998)

Conc. - concentration

ID - identification number

na - no test data available in the ERED database

NOED - no observed effect dose

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nd - not detected in this data set

Ratio = study area average concentration divided by reference average concentration

(1) With exception of mercury, lipid normalized tissue concentrations were not calculated for inorganic COPCs because inorganics are not expected to preferentially concentrate in lipid material

(2) ERED database records of several freshwater fish were queried - members of Ictaluridae, Centrarchidae, Cyprinidae, Percidae, and Esocidae.

(3) Citations for primary references are provided in the ERED database

(4) Value for Endrin

a Test involved PCBs, specific congeners not indicated